Spacelabs VxWorks Software Update

Vulnerability Mitigation

Xprezzon (91393), Qube (91390), Qube Mini (91389)
Software Version 3.08.03

077-0480-00 Rev B

Product Covered: Xprezzon(91393), Qube (91390), and Qube Mini(91389) Patient Monitors

Purpose: VxWorks Software Update – Vulnerability Mitigation.

Description:
An enterprise security firm has identified eleven vulnerabilities collectively known as "URGENT/11" in the VxWorks operating System software version 6.6 distributed by Wind River, which is used in certain Spacelabs products. For additional information, please visit https://www.spacelabshealthcare.com/products/security/security-advisories-and-archives/urgent-11-vulnerability-in-vxworks-ipnet-service/ The VxWorks vulnerability can allow a remote user to access a product and potentially disrupt patient monitoring.

Spacelabs Healthcare Service Personnel should install VxWorks patch software per standard operating procedures.

To mitigate the identified vulnerability and ensure device security is optimized, Healthcare service personnel can also install the VxWorks patch software using the following instruction set.

Dependencies:
The following process and procedures are dependent on monitor model and software version. Spacelabs has outlined a specific update procedure to follow based on which monitor type and software versions installed. See flow chart on page four to assist with determining the appropriate update procedure based on monitor model and software version.
- 3.08.03 is compatible with all hardware configurations.

Important Considerations:
Additional Command Module upgrades may be required for full features with newer monitoring software. For additional help contact Technical Support at 1-800-522-7025.

Table of Contents

Order of Operations:

The following are steps necessary to pre-plan an upgrade and to determine a suitable update procedure.

1. Register with Spacelabs Healthcare Security user group. Registration may take up to 48 hours for access approval so plan accordingly. Once registered you will receive an email with user name and password along with a download password to download the software zip. The zip file contains this CSN, VxWorks software and all related forms.
2. Once registered, download VxWorks patch software package, which includes the software and all available documentation, from https://www.spacelabshealthcare.com/wp-login.php?redirect_to=https%3A%2F%2Fwww.spacelabshealthcare.com%2Fproducts%2Fsecurity%2Fsecurity-advisories-and-archives%2Fvxworks-software-updates-for-spacelabs-devices%2F
Software and instructions should be extracted to USB drive or service laptop that will be used for updating monitor software.
3. Install MD5Summer and validate the .md5 hash files. See Appendix D.
4. Install FileZilla FTP server. See Appendix C for configuration.
5. Determine update process for software update using the flow chart on the next page.
6. See Appendix B for information on how to connect the Service Computer to the monitor.
7. Record the monitor's configuration per worksheet, Document 091-1197-00 Rev A and Document 091-1198-00 Rev A.
8. Update the monitor's software using the selected procedure.
9. Review settings and test monitor for full functionality after update is completed.
10. Repeat steps as necessary to update all affected monitors

Tools Required:

1. Laptop with Windows 7 or Windows 10. Must have administration privileges and USB and Ethernet ports available.
2. Ethernet crossover cable for computers made before 2005.
3. Ethernet patch cable
4. USB mouse (optional)
5. L2 switch (optional)
6. USB thumb drive (FAT32 formatted). USB Flash drives larger than 32GB have not been tested. (optional)
7. FileZilla server on the designated laptop (Appendix C).
8. Monitor software and MIR sheet.

How to Register with Spacelabs to Obtain Software:

Using your browser navigate to https://www.spacelabshealthcare.com/products/security/ and register as New User, or enter user name and password if you already have a valid login. New user registration may take 24 to 48 hours for authentication.

Once registered, navigate to VxWorks software update folder and download designated software and instructions. At the completion of software updates, complete the MIR and email to installedbase@spacelabs.com. MIR may contain multiple entries.

FTP Server Instructions

Download FileZilla Server from https://filezilla-project.org/ Follow configuration instructions via Appendix C.

Determining SW Update Procedure:

To assist with determining which model type and SW version are currently in place, follow the diagram below, then proceed to the appropriate update procedure. Xprezzon, Qube and Qube Mini model numbers include (**91389, 91390, and 91393 sw 3.08.03)**

Note:

The FTP load procedure (Procedure 2) will work for newer software though the USB load procedure (Procedure 1) is preferred.

```
                              ┌──────────┐
                              │  START   │
                              └────┬─────┘
                                   │
                          ┌────────▼────────┐          No
                          │ Determine       │◄──────────────────┐
                          │ Monitor Model   │                   │
                          └────────┬────────┘                   │
                                   │                            │
                                   │                            │
                      ◇────────────▼──────────◇     No   ◇──────────────◇  yes  ┌──────────────┐
                      Is Monitor UVSL          ─────────►Is Monitor      ──────►│ Press the '?'│
                      91367,91369,91370,                 Xprezzon 91393,        │ button twice │
                      91387?                              Qube 91390, Mini       │ to determine │
                      ◇────────────┬──────────◇           91389?                 │ monitor SW   │
                              Yes  │                      ◇──────────────◇       │ Version      │
                                   │                                             └──────┬───────┘
                      ┌────────────▼────────┐                                           │
                      │ Initial SW release  │                                  ◇────────▼────────◇
                      │ does not support    │                                  Is SW Version
                      │ UVSL                │           ┌──────────┐   No      3.03.00 or
                      └────────────┬────────┘           │ Proceed  │◄──────────higher?
                                   │                    │ to       │          ◇────────┬────────◇
                      ◇────────────▼──────────◇         │ Procedure│                   │ Yes
                      Notification will be              │ 2 of CSN │           ┌───────▼────────┐
                      released when UVSL                └────┬─────┘           │ Proceed to     │
                      VxWorks update is                      │                 │ Procedure 1    │
                      available                               │                 │ of CSN         │
                      ◇────────────┬──────────◇              │                 └───────┬────────┘
                                   │                          │                         │
                              ┌────▼────┐              ┌──────▼──────┐          ┌───────▼──────┐
                              │  END    │              │ Perform SW  │          │ Perform SW   │
                              └─────────┘              │ Update per  │          │ Update per   │
                                                       │ Procedure   │          │ Procedure    │
                                                       └─────────────┘          └──────────────┘
```

VxWorks SW Update Process

Overview

The S-class family of monitors consists of the Xprezzon, Qube, and Qube mini monitors.

- 91390 (Qube)
- 91393 (Xprezzon)
- 91389 (Qube Mini)

Programming (using procedure 2) of S-class monitors consists of these eight steps:

1. Download and verify software distribution files from https://www.spacelabshealthcare.com/wp-login.php?redirect_to=https%3A%2F%2Fwww.spacelabshealthcare.com%2Fproducts%2Fsecurity%2Fsecurity-advisories-and-archives%2Fvxworks-software-updates-for-spacelabs-devices%2F (must be registered user)
2. Using a network connection, connect the Service Computer to the target monitor.
3. Program the boot-sector of the monitor CPU Flash ROM.
4. Program the application-sector of the monitor CPU Flash ROM.
5. Program the *FD_Image.bin* (XPREZZON) or *FD_Image_c. bin* (Qube and Qube Mini) sector of the monitor CPU Flash ROM.
6. Zero the NVRAM on the CPU board.
7. Format the internal USB Flash drive.
8. Verify monitor configuration settings.

On Service Computer (Laptop)

1. Download software from the following link

   https://www.spacelabshealthcare.com/wp-login.php?redirect_to=https%3A%2F%2Fwww.spacelabshealthcare.com%2Fproducts%2Fsecurity%2Fsecurity-advisories-and-archives%2Fvxworks-software-updates-for-spacelabs-devices%2F (must be a registered user).

2. The downloaded Zip will contain the following folders: See Figure 1.
   - 3.08.03 release – contains the software for the Moniotor update, Figure 2 and 3.
   - Customer Service Notice VxWorks – contains the VxWorks CSN 077-0480
   - Forms – Contains configuration template forms
   - MD5 Summer – contains the MD5 Summer Application
   - MIR – contains the MIR form to be completed and returned to installedbase@spacelabs.com.

3. Open the 3.08.03 SW folder, copy the mini, qube, and salish folders, and put them into the appropriate directory depending on the procedure to be performed. The root directory of the USB drive if updating via USB and the C drive if using the FTP client.
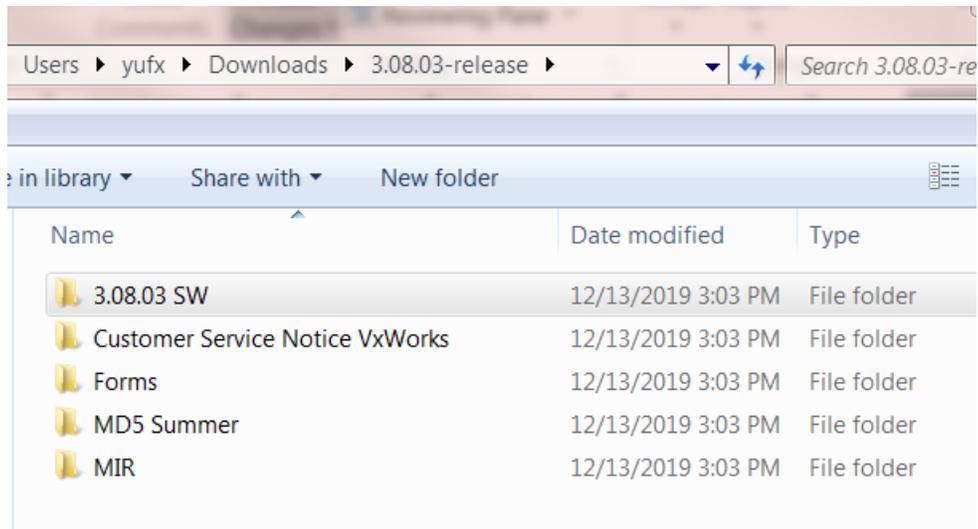
Figure 1: Contents of 3.08.03 release, the downloaded zip file
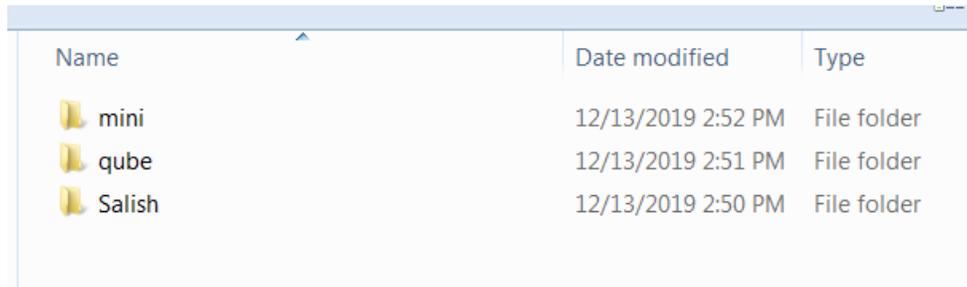
Figure 2: Contents of the 3.08.03 folder
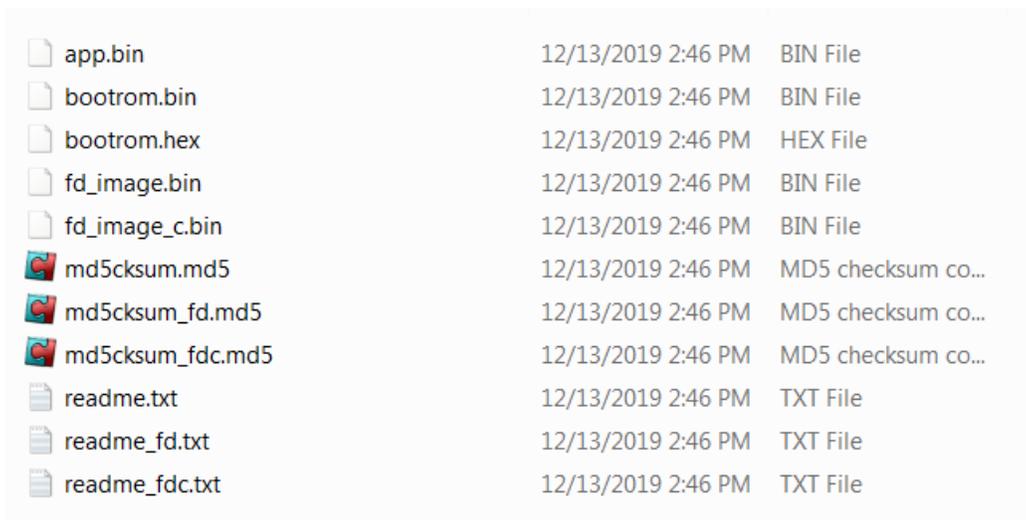
Figure 3: Contents of the <monitor>/app folder

Important Note: Be sure to Install MD5 Summer and configure per Appendix D.
Navigate to the folder of the software you will be installing:
- \mini\app
- \qube\app or
- \salish\app

Double click on the .md5 files in the folders, Figure 3. Make sure app.bin, bootrom.bin, and bootrom.hex and FD_image.bin or FD_image_c.bin all indicate OK before loading them into the monitor, see Figures 4 and 5.
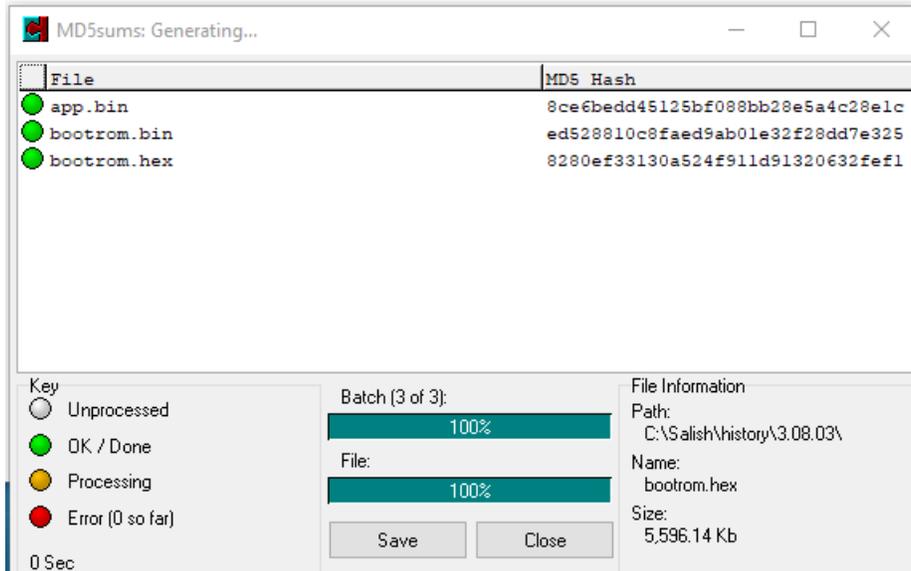
Figure 4: Verifying File Integrity
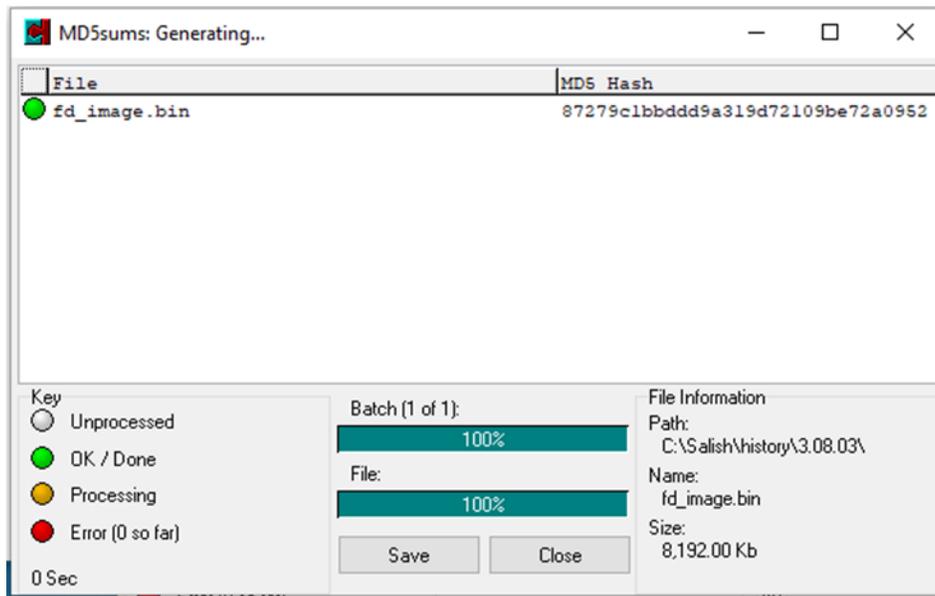
Figure 5: Verifying file integrity

On USB Flash Thumb Drive

Minimum installed software version required to program Xprezzon / Qube monitors via a USB thumb drive is 3.03.00.

⚠️	***The USB thumb drive must be formatted FAT32****. The Xprezzon and Qube monitors cannot read NTFS-formatted drives.* *USB Flash drives larger than 32GB have not been tested.*

S-class monitors (Xprezzon /Qube / Qube Mini) expect the software on the USB Flash drive in the same folder structure as it is on the Service Computer:

- **Xprezzon**: the *\salish\app* folder must be in the root of the USB flash drive.
- **Qube:** the *\Qube\app* folder must be in the root of the USB flash drive.
- **Qube Mini:** the *\mini\app* folder must be in the root of the USB flash drive.

Assuming the USB drive is e:\, the folder structure will look like Figure 6.
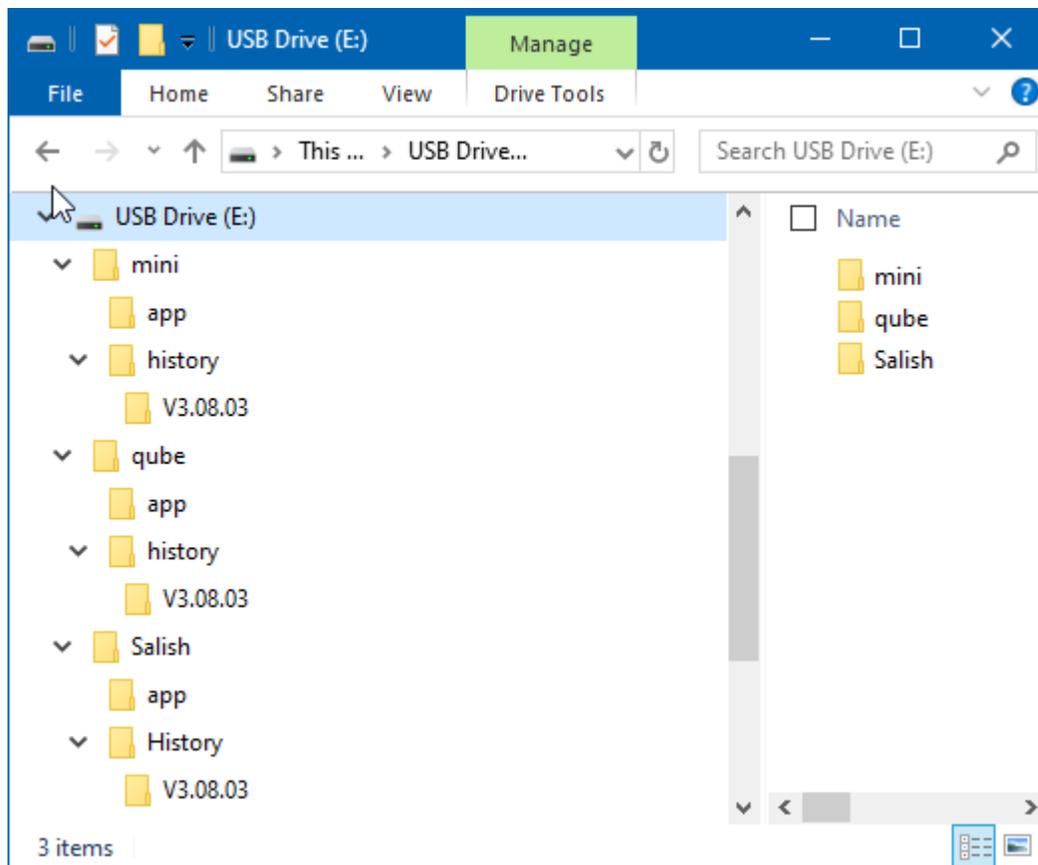
Figure 6: USB thumb drive folder structure

To program the Xprezzon/Qube/Qube Mini monitor via the USB thumb drive, go to Procedure 1.
To program the Xprezzon/Qube/Qube Mini monitor via FTP, go to Procedure 2.

<u>Procedure 1</u>: Programming Xprezzon /Qube/ Qube mini monitors via USB Flash Drive

⚠️ *Please review all steps for clarity and order before proceeding with SW update.*

Avoid programming any monitor while it is actively monitoring patients. Although rare, programming failures may render the monitor inoperative. Work with the hospital staff to provide backup monitoring while you program the monitor.

Programming the Xprezzon, Qube, and Qube Mini monitors will result in loss of patient data. Again, work with the hospital staff in saving any patient data they may need.

⚠️ *The monitor configuration memory (NVRAM) must be zeroed after programming. To ensure system configurations are returned to their pre-upgrade configurations, Biomed and Clinical menu baseline settings must be documented prior to beginning the programming procedure. In addition, for systems being updated by an FSE, the target monitor Sysgen (licensing) values must be documented.*

Important Note: Complete documents 091-1197-00 Rev A and 091-1198-00 Rev A to record the Biomed, Clinical, and Network menu settings prior to the software update.

Procedure

Ensure that the monitor is not on the hospital network during the upgrade. Disconnect the network cable from the wall and on a Qube or Qube Mini, confirm wireless radio is disabled while performing this process.

Minimum installed software version required to program XPREZZON / Qube monitors via a USB flash thumb drive is 3.03.00.

⚠️ **The USB Flash thumb drive must be formatted FAT32***. The XPREZZON and Qube monitors cannot read NTFS-formatted drives.*
USB Flash drives larger than 32GB have not been tested.

- S-class monitors expect to find the required software files in the *c:\qube\app*, *c:\mini\app, c:\salish\app* folder on the Service Computer.
- Copy, do not Move, all the files from the respective History folder to the respective **app** folder.

Make sure the software files are in the ***appropriate*** folder on the USB thumb drive:

- **Xprezzon:** *\salish\app* folder must be in the root of the USB flash drive.
- **Qube:** *\Qube\app* folder must be in the root of the USB flash drive.
- **Qube Mini:** *\mini\app* folder must be in the root of the USB flash drive.

Also ensure that the \<monitor>\app folder contains the following files, figure 3:

- app.bin
- bootrom.bin
- bootrom.hex
- fd_image.bin
- fd_image_c.bin
- md5cksum.md5
- md5cksum_fd.md5
- md5cksum_fdc.md5
- readme.txt
- readme_fd.txt
- readme_fdc.txt

1. Take note of the checksum values for the *app.bin* and *bootrom.bin* files located in the *readme.txt* file. The following are the app.bin and bootrom.bin checkum values for software version 3.08.03:

   app.bin   0x45c442af
   bootrom.bin   0x08dbc47e

> 👉 **NOTE** *The **FD_Image.bin** for XPREZZON and **FD_Image_c.bin** for Qube and Qube mini monitors do not have a published checksum.*

2. Install the USB thumb drive, with the software files copied into the app folder, on any open USB port on the monitor.

3. Enter Extended Diagnostics. Cycle power on the monitor. During the 4-3-2-1 countdown, Figure 7, touch the lower-left corner of the touchscreen, and then touch the lower-right corner. Do not touch both corners at the same time, Figure 8. If using a mouse, press both mouse buttons simultaneously during the countdown.


```
                        VxWorks System Boot

Copyright 1984-2007  Wind River Systems, Inc.

CPU: Spacelabs - MPC8270
Version: VxWorks 6.6
BSP version: 2.0/13 3.08.01/0010
Creation date: Jun 21 2018, 14:39:48
Boot kernel checksum = 0x08dbf10f
Application checksum = 0x45d424f8

Model = 91393 XPREZZON

CPU board P/N = 670-1536-02
Cpu board serial no.: 000017252301
Physical memory top = 0x4000000
System memory top    = 0x4000000
Node Id = 122
  2
```
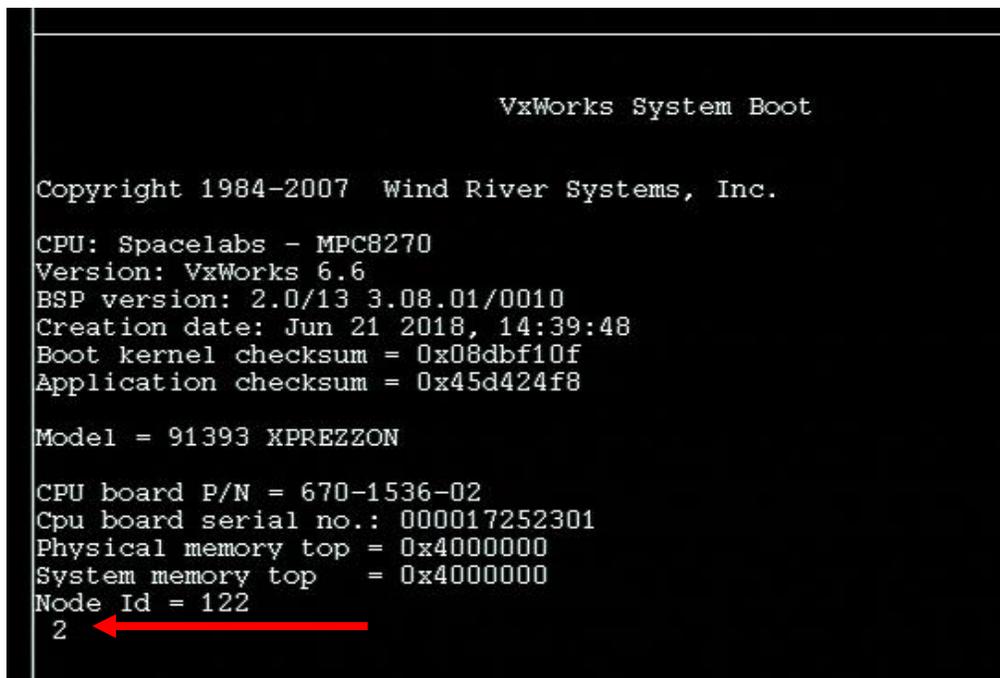
Figure 7: Touch the screen or click the mouse buttons before this countdown gets to zero.

Figure 8: Touch the lower-left corner of the touchscreen, then touch the lower-right corner. Do not touch both corners at the same time.

35

4. Select **p – print boot params** from the main menu. Verify there is an **other (o) : /bd0** (zero) entry. See Figure 9. If missing go to step 5; if it does exist, press any key
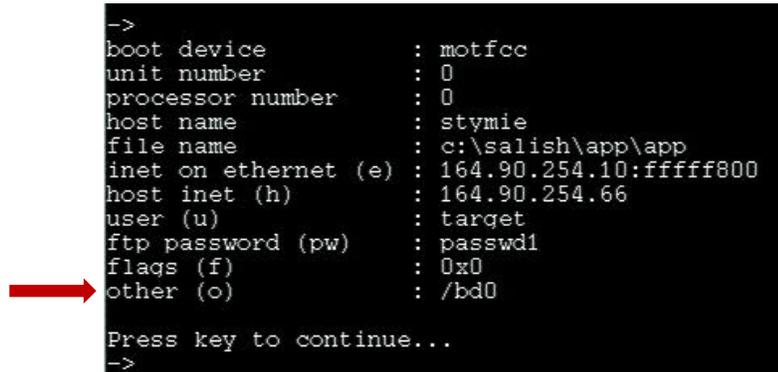

```
->
boot device          : motfcc
unit number          : 0
processor number     : 0
host name            : stymie
file name            : c:\salish\app\app
inet on ethernet (e) : 164.90.254.10:fffff800
host inet (h)        : 164.90.254.66
user (u)             : target
ftp password (pw)    : passwd1
flags (f)            : 0x0
other (o)            : /bd0

Press key to continue...
->
```

Figure 9: Print boot params

5. If the **other (o): /bd0** entry does not exist. Press any key then select **c – change boot params** from the main menu. Select **<enter>** until the **other (o)** field appears. Type **/bd0**, then **<enter>. Note: /bd0 must be all lowercase**

> ☞ **NOTE** *Notice it is a forward-slash, not a backslash, and that it is the number zero, not the letter o.*

6. Again select **p – print boot params** from the main menu, and verify the **other (o) : /bd0** entry exists. See Figure . Press any key to go to the main menu.

7. Select **b – burn flash…** from the main menu. The Burn Flash menu appears. Be sure the file source is the USB drive, and the default path is correct. See Figure 10.


```
->
File source USB drive...
drive /bd0 mounted [0]

default USB file path:

  /bd0/salish/app


e - edit USB file path

g - use USB file path as specified

C - CANCEL and return to main menu

  ┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐
  │  e  │ │     │ │  g  │ │     │ │  C  │
  └─────┘ └─────┘ └─────┘ └─────┘ └─────┘
->
```

Figure 10: Burn Flash from USB drive menu

8. Select **g – use USB file path as specified**. The second-level burn flash menu appears. See Figure11.

```
a - application image

b - boot image

x - flash drive image

C - CANCEL and return to main menu
    ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐
    │      │ │      │ │      │ │      │ │      │ │      │ │      │ │      │
    │  a   │ │      │ │  b   │ │      │ │  x   │ │      │ │      │ │  C   │
    │      │ │      │ │      │ │      │ │      │ │      │ │      │ │      │
    └──────┘ └──────┘ └──────┘ └──────┘ └──────┘ └──────┘ └──────┘ └──────┘
->
```

Figure 11: Burn Flash menu

9. **Always burn the boot image first**. Select the **b - boot image** key. The monitor will show a series of dots progressing across the bottom of the screen. After programming is complete (less than two minutes), the monitor will display the following:

```
->
Burning BOOT Flash...
boot version 3.08.03/0003 is compatible with CPU board P/N = 670-1536-02
.......................................................

Flash burning complete.
Boot kernel checksum = 0x08dbc47e

Clearing the error log, App will initialize...

The monitor will restart when any key is pressed.
Press key to continue...
->
```
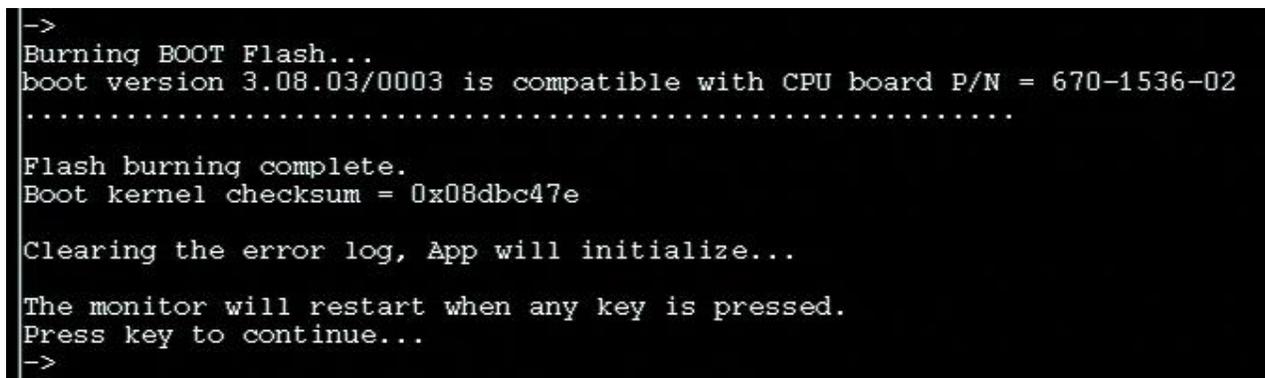
Figure 12: S-class monitors boot image flash burn (USB) complete

THIS STEP IS CRUCIAL, DO NOT SKIP IT!

10. Verify the boot kernel checksum displayed on the monitor is the same as the *bootrom.bin* checksum value specified in the *readme.txt* file, see step 1.
    The following is the app.bin and bootrom.bin checkum values for software version 3.08.03:
    > app.bin   0x45c442af
    > bootrom.bin   0x08dbc47e

    a. If the checksum values match (a successful load), go to the next step.

    b. If the values do not match, (an unsuccessful load) select the **Continue…** key and repeat steps 7 through 10 again. See the troubleshooting section Appendix A if the subsequent attempts continue to fail.

11. Select the **Continue…** key. The monitor will automatically enter Extended Diagnostics again.

12. Select **b – burn flash…** from the main menu. The Burn Flash menu appears. Be sure the file source is the USB drive, and the default path is correct.

13. Select the **g – use USB file path as specified** key. The second-level burn flash menu appears.

14. Select the **a – application image** key. The monitor will show a series of dots progressing across the bottom of the screen. After programming is complete (less than two minutes), the monitor will display the following:

```
->
Burning Application Flash...
.........................................................................
.........................................................................
.........................................................................
.........

Flash burning complete.
Application checksum = 0x45c442af

The monitor will restart when any key is pressed.
Press key to continue...
->
```

Figure 13: S-class monitors application image flash burn (USB) complete

CAUTION!

THIS STEP IS CRUCIAL, DO NOT SKIP IT!

15. Verify the Application checksum displayed on the monitor is the same as the *app.bin* checksum value specified in the *readme.txt* file.

    a. If the checksum values match (a successful load), go to the next step.

    b. If the values do not match, (an unsuccessful load) repeat steps 12 through 15 again. See the troubleshooting section Appendix A if the subsequent attempts continue to fail.

16. Select the **Continue…** key. The monitor will enter Extended Diagnostics once again.

17. From the Extended Diagnostics main menu, select the **b - burn flash** key. The burn flash menu appears.

18. Select the **g – use USB file path as specified** key, and then the **x- flash drive image** key.

19. The monitor will again show a series of dots progressing across the bottom of the screen. After programming is completed (about one to three minutes), the monitor will display the following (see Figure 14):

> **NOTE**
> *For a given version of software, XPREZZON, Qube and mini Qube monitors share the same* bootrom.bin *and* app.bin *files.*
> *However, the XPREZZON uses the* **FD_Image.bin** *file, and the Qube and Qube mini use the* **FD_Image_c.bin** *file. It is acceptable that both files are in the \app folder – the monitor being programmed knows which file to install.*

```
->
Burning Flash File System Image...
.............................

Verifying checksum..

Flash file system image complete.
```

Figure 14: S-class monitors FD_Image flash burn complete

20. The monitor will return one of the following messages:
    a. *Flash file system image complete:* the checksum test passed (a successful load), go to the next step.

    b. *Flash file system checksum mismatch:* the checksum test failed (an unsuccessful load). Repeat steps 17 through 20 again. See the troubleshooting section Appendix A if the subsequent attempts continue to fail.

21. Select the **Continue… key**. The monitor will automatically enter Extended Diagnostics once again.

22. The NVRAM must be zeroed after programming the monitor.

> ☞ **NOTE** *The NVRAM can be zeroed from Extended Diagnostics without a Sysgen datakey attached to the monitor serial port.*
> *Network configurations and the Option-string will be retained if the datakey is not attached when the NVRAM is zeroed.*

23. From the Extended Diagnostics main menu, select the **z – zero NV ram** key.

    a. If the Sysgen datakey is present on the monitor serial port, the NVRAM will be zeroed completely, immediately. All configurations, including the Option string will be set to Factory Defaults. **Spacelabs FSEs only.**

    b. If the datakey is **not** installed, you must first confirm clearing of the NVRAM. Network configurations and the option-string will be retained, see figure 15.

Figure 15: Confirm Clearing of NVRAM without datakey

24. From the Extended Diagnostics main menu, select the **f – format USB file system** key and then the
    f - Format internal USB drive key.

25. From the Extended Diagnostics main menu, select the **D – run diagnostics…** key, and then the
    R - Reset monitor (cold boot) key. Allow the monitor to fully boot into the user interface.

> ⚠ *If, after rebooting, the monitor displays the "*System software failure*" message instead of the GUI, refer to the troubleshooting section Appendix A.*

System software failure. Review error log for further details.
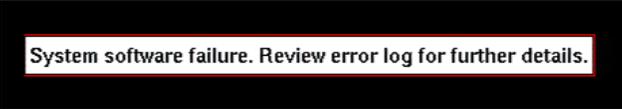
26. Programming of the XPREZZON / Qube monitor is complete.

27. Be sure to configure the monitor settings back to the original values, especially if you changed the monitor IP Address, or zeroed the NVRAM back to factory defaults. Any Customized Trends, DNA and wireless certificates will also have to be reinstalled.

28. Complete MIR after each monitor update.

29. Email completed MIR after all monitors have been updated to installedbase@spacelabs.com

IF YOU EXPERIENCE ANY PROBLEMS DURING THIS PROCEDURE, REFER TO APPENDIX A FOR TROUBLESHOOTING.

For any additional information or troubleshooting, Please contact Spacelabs Technical Support 1-800-522-7025.

<u>Procedure 2</u>: Programming Xprezzon /Qube / Qube Mini monitors via FTP

> ⚠️ *Please review all steps for clarity and order before proceeding with SW update.*

Avoid programming any monitor while it is actively monitoring patients. Although rare, programming failures may render the monitor inoperative. Work with the hospital staff to provide backup monitoring while you program the monitor.

Ensure that the monitor is not on the hospital network during the upgrade. Disconnect the network cable from the wall and on a Qube or Qube Mini, confirm wireless radio is disabled while performing this process.

Programming the Xprezzon, Qube and Qube Mini monitors will result in loss of patient data. Again, work with the hospital staff in saving any patient data they may need.

> ⚠️ *To ensure system configurations are returned to their pre-upgrade configurations Biomed and Clinical menu baseline settings must be documented prior to beginning the programming procedure. In addition, for systems being updated by an FSE, the target monitor Sysgen (licensing) values must be documented.*

Important Note: Complete documents 091-1197-00 Rev A and 091-1198-00 Rev A to record the Biomed and Clinical menu settings prior to the software update.

91393 Xprezzon Monitor Pre-Steps

1. In the Biomed Menu, document the current Network Setup/TCP/IP settings, and then make the following changes , see Figure 16:

   - If DHCP is enabled (the key is blue) disable it by touching the DHCP key.
   - IP Address: 164.90.254.10
   - Subnet Mask: 255.255.255.0
   - Gateway Address: nothing (clear the field)
   - Touch Save and reset the monitor
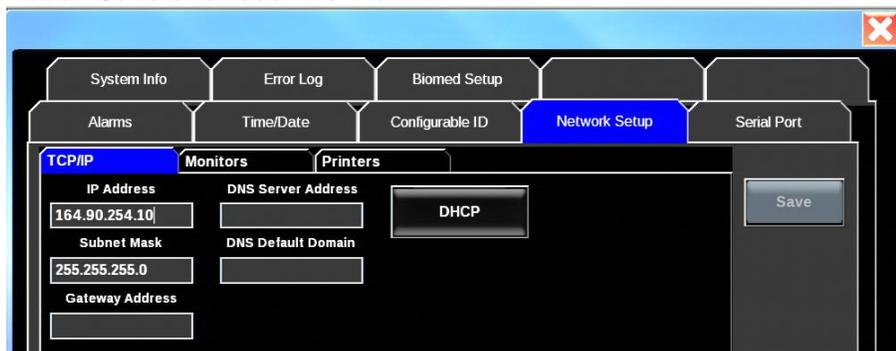
Figure 16: Monitor Network Setup

2. Access the Extended Diagnostics menu. Cycle power on the monitor. During the 4-3-2-1 countdown, touch the lower-left corner of the touchscreen, and then touch the lower-right corner. Do not touch both corners at the same time. If using a mouse, press both mouse buttons simultaneously during the countdown. See Figure 7 and 8 on page 13.

3. From the Main Menu, choose **p – print boot params**. Verify the settings are the same as below(See Figure 17):

  - Ensure the file name is **\salish\app\app**
  - Ensure no gateway is listed

```
->
boot device          : motfcc
unit number          : 0
processor number     : 0
host name            : stymie
file name            : \salish\app\app
inet on ethernet (e) : 164.90.254.10:ffffff00
host inet (h)        : 164.90.254.66
user (u)             : target
ftp password (pw)    : passwd1
flags (f)            : 0x0

Press key to continue...
->
```

Figure 17: Boot Parameters for 91393 Xprezzon monitor

  - If any entry is wrong, choose **c – change boot params** from the Main Menu.
  - If the displayed parameter value is correct, touch ENTER to go to the next parameter.
  - If the displayed parameter value is incorrect, use the DELETE key to erase the entry up to the ->, and then enter the correct value. Touch ENTER to go to the next parameter.
  - Continue until you return to the Main Menu. Choose **p – print boot params** again to verify the settings are the same as shown in Figure 17.

91390 Qube Pre-Steps:

1. In the Biomed Menu, document the current Network Setup/TCP/IP settings, and then make the following changes(Figure 18):
   - If DHCP is enabled (the key is blue) disable it by touching the DHCP key.
   - IP Address: **164.90.254.10**
   - Subnet Mask: **255.255.255.0**
   - Gateway Address: nothing (clear the field)
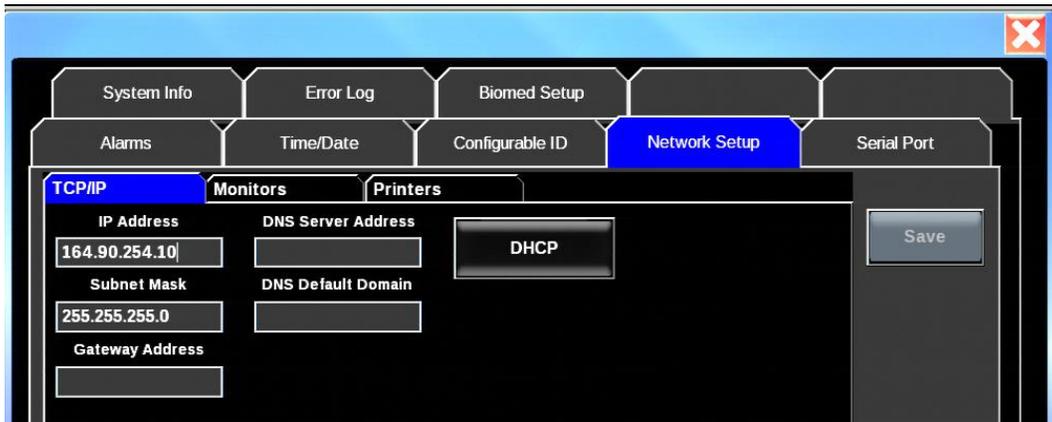
Figure 18: Monitor Network Setup

   - Touch Save and then touch Reset Monitor.

2. Access the Extended Diagnostics menu of the monitor. Cycle power on the monitor. During the 4-3-2-1 countdown, touch the lower-left corner of the touchscreen, and then touch the lower-right corner. Do not touch both corners at the same time. If using a mouse, press both mouse buttons simultaneously during the countdown. See Figure 7 and 8.
3. From the Main Menu, choose **p – print boot params**. (Note: There is both a lower and upper case 'P' in the menu; please select the lower case p for this step.) Verify the settings are the same as below(See Figure 19):
   - Make sure the file name is **\qube\app\app**
   - Be sure no gateway is listed

```
->
boot device          : motfcc
unit number          : 0
processor number     : 0
host name            : stymie
file name            : \qube\app\app
inet on ethernet (e) : 164.90.254.10:ffffff00
host inet (h)        : 164.90.254.66
user (u)             : target
ftp password (pw)    : passwd1
flags (f)            : 0x0

Press key to continue...
->
```
Figure 19: Boot Parameters for 91390 Qube monitor

- If any entry is wrong, press the Continue key, then choose **c – change boot params** from the Main Menu.
- If the displayed parameter value is correct, touch ENTER to go to the next parameter.
- If the displayed parameter value is incorrect, use the DELETE key to erase the entry up to the ->, and then enter the correct value. Touch ENTER to go to the next parameter.
- Continue until you return to the Main Menu. Choose p – print boot params again to verify the settings are the same as shown in Figure 19

Refer to *Appendix C* for installation and configuration of the FileZilla FTP server. By default, S-class (Xprezzon /Qube/ Qube Mini) monitors expect the Service Computer's IP Address to be 164.90.254.66/ 255.255.255.0. If the monitor is not on the same IP network, document its current IP configuration, and then change the address to 164.90.254.10/ 255.255.255.0.

Procedure

1. Initially the Qube and Xprezzon monitors shared the same folder structure on the Service Computer: *c:\salish\app*. However, beginning with software version 3.03.00, the Qube should have its own folder structure *c:\Qube\app*. The Qube Mini should have its own folder as well, *c:\mini\app*.

2. On your service laptop, copy, the mini, qube, and salish folders from the downloaded zip file onto the C drive. See figures 1-3.

3. Take note of the checksum values for the *bootrom.bin* and *app.bin* files located in the *readme.txt* file. The following is the app.bin and bootrom.bin checkum values for software version 3.08.03:

    app.bin   0x45c442af
    bootrom.bin   0x08dbc47e

    See Figure 20.

👉 **NOTE**	*The* FD_Image.bin *for XPREZZON and* FD_Image_c.bin *for Qube and Qube mini monitors do not have a published checksum.*

Figure 20: Example of Checksum Values for S-class monitors in the readme.txt file

4. Power-on the target monitor, and allow it to fully boot. Connect the Service Computer to the monitor using a direct (crossover) network connection. See *Appendix B* for information on how to connect the Service Computer to the monitor.

5. Start the *FileZilla Server* application. Figure 21.
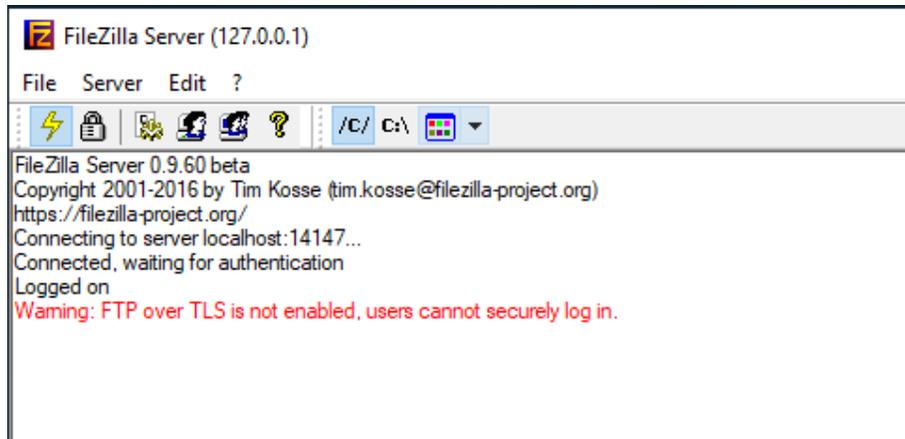
Figure 21: FileZilla Application Running

6. Cycle power on the target monitor. During the 4-3-2-1 countdown, touch the lower-left then lower-right corners of the screen sequentially to enter Extended Diagnostics, Figure 22. If using a mouse, press both mouse buttons simultaneously during the countdown.

Figure 22: Extended Diagnostics, Main Menu

7. From the Extended Diagnostics main menu, select the **b - burn flash…** key. See Figures 22 and 23. Be sure the File source is network FTP.
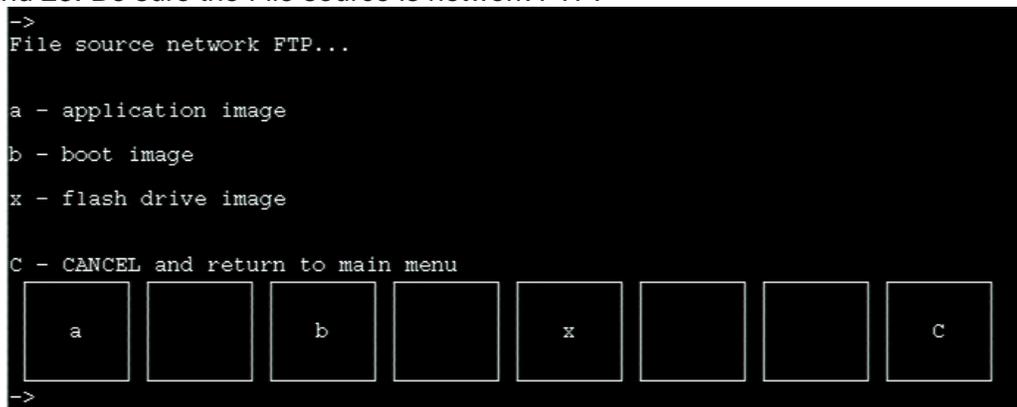

Figure 23: S-class Burn Flash Menu (FTP)

8. **Always burn the boot image first**. Select the **b - boot image** key. Watch the FileZilla window and verify the target monitor made the connection to the FTP server, see Figure 24.

⚠️ *If the monitor returns an* <u>ftpXfer error</u>, *go to the troubleshooting section Appendix A.*
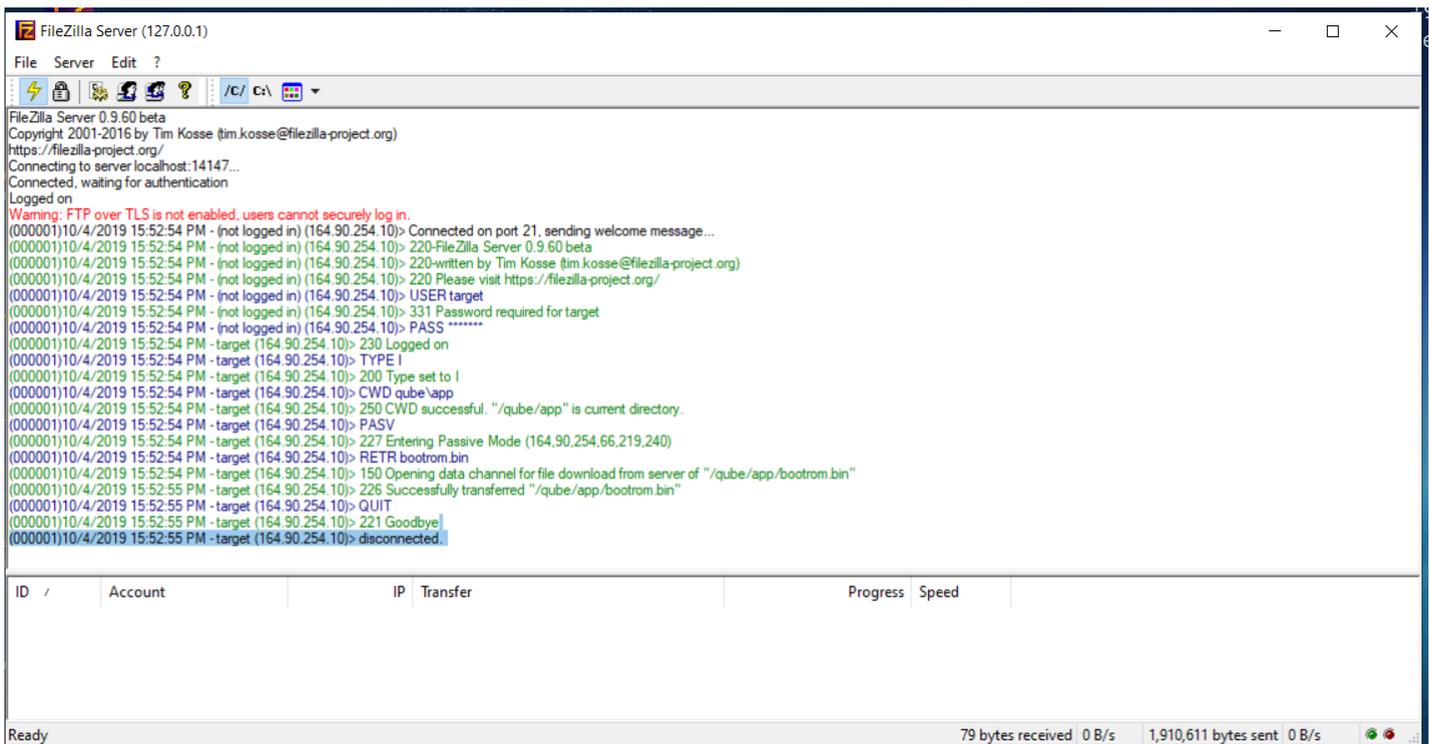

Figure 24: Target monitor logged in to the FTP Server. (*bootrom.bin* successful)

9. The monitor will show a series of dots progressing across the bottom of the screen. After programming is complete (less than two minutes), the monitor will display the following:

```
->
Burning BOOT Flash...
boot version 3.08.03/0003 is compatible with CPU board P/N = 670-1536-02
..................................................
Flash burning complete.
Boot kernel checksum = 0x08dbc47e

Clearing the error log, App will initialize...

The monitor will restart when any key is pressed.
Press key to continue...
->
```

Figure 25: S-class monitors boot image flash burn (FTP) complete

THIS STEP IS CRUCIAL, DO NOT SKIP IT!

10. Verify the boot kernel checksum displayed on the monitor is the same as the *bootrom.bin* checksum value specified in the *readme.txt* file.
    The following is the app.bin and bootrom.bin checkum values for software version 3.08.03:
app.bin	0x45c442af
bootrom.bin	0x08dbc47e

    a. If the checksum values match (a successful load), go to the next step.

    b. If the values do not match, (an unsuccessful load) select the **Continue…** key and repeat steps 7 through 10 again. See the troubleshooting section Appendix A if the subsequent attempts continue to fail.

11. Select the **Continue…** key. Enter Extended Diagnostics again. Do not allow the monitor to fully boot.

> **NOTE** *Beginning with **v3.03.00**, the monitor will automatically re-enter Extended Diagnostics when the **Continue…** key is selected.*

12. From the Extended Diagnostics main menu, select the **b - burn flash** key. The burn flash menu will appear again.

13. Select the **a - application image** key. Watch the FileZilla window and verify the target monitor made the connection to the FTP server.

14. The monitor will again show a series of dots progressing across the bottom of the screen. After programming is completed (about one to three minutes), the monitor will display the following:


```
->
Burning Application Flash...
..........................................................................
..........................................................................
..........................................................................
.........

Flash burning complete.
Application checksum = 0x45c442af

The monitor will restart when any key is pressed.
Press key to continue...
->
```

Figure 26: S-class monitors application image flash burn (FTP) complete.

THIS STEP IS CRUCIAL, DO NOT SKIP IT!

15. Verify the Application checksum displayed on the monitor is the same as the *app.bin* checksum value specified in the *readme.txt* file.

    The app.bin checksum value is 0x45c442af.

    a. If the checksum values match (a successful load), go to the next step.
    b. If the values do not match, (an unsuccessful load) repeat steps 12 through 15 again. See the troubleshooting section Appendix A if the subsequent attempts continue to fail.

16. Select the **Continue…** key. Enter Extended Diagnostics once again. Do not allow the monitor to fully boot.

17. From the Extended Diagnostics main menu, select the **b - burn flash** key. The burn flash menu appears.

18. Select the **x – flash drive image** key. Watch the FileZilla window and verify the target monitor made the connection to the FTP server.

19. The monitor will again show a series of dots progressing across the bottom of the screen. After programming is completed (about one to three minutes), the monitor will display the following the message in Figure 27.

👉 **NOTE**	*For a given version of software, Xprezzon, Qube and Qube Mini monitors share the same* **bootrom.bin** *and* **app.bin** *files.* *However, the Xprezzon uses the* **FD_Image.bin** *file, while the Qube and Qube Mini use the* **FD_Image_c.bin** *file. It is acceptable that both files are in the \app folder – the target monitor knows which file to install.*

```
->
Burning Flash File System Image...
..............................

Verifying checksum..

Flash file system image complete.
```

Figure 27: S-class monitors FD_Image flash burn complete

⚠ CAUTION!
THIS STEP IS CRUCIAL, DO NOT SKIP IT!

20. The monitor will return one of the following messages:
    a. *Flash file system image complete:* the checksum test passed (a successful load), go to the next step.

    b. *Flash file system checksum mismatch:* the checksum test failed (an unsuccessful load). Repeat steps 17 through 20 again. See the troubleshooting section Appendix A if the subsequent attempts continue to fail.

21. Select the **Continue… key**. The monitor will automatically enter Extended Diagnostics once again.

22. The NVRAM must be zeroed after programming the monitor.

👉 **NOTE**	*The NVRAM can be zeroed from Extended Diagnostics without a Sysgen datakey attached to the monitor serial port.* *Network configurations and the Option-string will be retained if the datakey is not attached when the NVRAM is zeroed.*

23. From the Extended Diagnostics main menu, select the **z – zero NV ram** key.

    a. If the Sysgen datakey is present on the monitor serial port, the NVRAM will be zeroed completely, immediately. All configurations, including the Option string will be set to Factory Defaults. Spacelabs FSEs only.

    b. If the datakey is **not** installed, you must first confirm clearing of the NVRAM. Network configurations and the option-string will be retained.

Figure 28: Confirm Clearing of NVRAM without datakey

24. From the Extended Diagnostics main menu, select the **f – format USB file system** key and then the **f - Format internal USB drive** key.

25. From the Extended Diagnostics main menu, select the **D – run diagnostics…** key, and then the **R - Reset monitor (cold boot)** key. Allow the monitor to fully boot into the user interface.

---

*If, after rebooting, the monitor displays the "*System software failure*" message instead of the GUI, refer to the troubleshooting section Appendix A.*

System software failure. Review error log for further details.

---

26. Programming of the Xprezzon / Qube / Qube Mini monitor is complete. Be sure to follow any additional procedures specified in the applicable PSN.

27. Be sure to configure the monitor settings back to the original values, especially if you changed the monitor IP Address, or zeroed the NVRAM back to factory defaults. Any Customized Trends, DNA and wireless certificates will also have to be reinstalled.

28. Complete MIR after each monitor update.

29. Email completed MIR after all monitors have been update to installedbase@spacelabs.com.

IF YOU EXPERIENCE ANY PROBLEMS DURING THIS PROCEDURE, REFER TO <u>APPENDIX A</u> FOR TROUBLESHOOTING.

<u>Appendix A</u>: Troubleshooting Xprezzon, Qube, Qube Mini Monitor Programming Issues

Monitor returns an ftpXfer error when initializing flash burn:

```
->
Burning BOOT Flash...
Target Name: vxTarget
ftpXfer error
File path is: \salish\app

WARNING:
An error was detected during the flash burning
process. DO THE FOLLOWING:

Verify that the boot parameters below are correct and the file exists.
If correct, attempt to burn flash again by pressing any key.
If incorrect, cycle power, edit the boot parameters, and burn flash.

boot device          : motfcc
unit number          : 0
processor number     : 0
host name            : stymie
file name            : \salish\app\app
inet on ethernet (e) : 164.90.254.10:ffffff00
host inet (h)        : 164.90.254.66
user (u)             : target
ftp password (pw)    : passwd1
flags (f)            : 0x0

Press key to continue...
->
```

Figure 29: ftpXfer error.

The *ftpXfer error* can be caused by a number of things:

1. The FileZilla Server application is not running on the Service Computer.

2. The required files *bootrom.bin, app.bin, fd_image.bin, (fd_image_c.bin)* are not in the expected folder on the Service Computer or USB Flash drive:

   - Xprezzon……………….…………………………….c:\salish\app
   - Qube prior to v3.03.00…………………………………c:\salish\app
   - Qube v3.03.00 and later…………………………………c:\Qube\app
   - Qube Mini……………………………………………….c:\mini\app

3. The boot parameters on the target computer are incorrect.
   - Enter Extended Diagnostics. Touch **p - print boot params**.
   - Compare the settings with the factory-default settings below.

```
boot device            : motfcc
unit number            : 0
processor number       : 0
host name              : stymie
file name              : \salish\app\app
inet on ethernet (e) : 164.90.254.10:ffffff00
host inet (h)          : 164.90.254.66
user (u)               : target
ftp password (pw)      : passwd1
flags (f)              : 0x0
```

Path to the *bootrom.bin*, *app.bin* and *fd_image.bin* files. Notice it is a backslash (\) not (/)
Default IP Address & Subnet Mask of the monitor. Actual address will be different
Service Computer's IP Address

0x0=static IP; 0x40=DHCP

- If the **inet on ethernet (e)** value is on an IP network other than 164.90.254.xx:ffffff00, write down its value, and then change the address to 164.90.254.10:ffffff00, using the Change Boot Parameters utility in the Extended Diagnostics main menu.
- After programming the monitor, be sure to return the monitor to its original address.

4. Incorrect connection between Service Computer and target monitor.

   - Allow the target monitor to fully boot.
   - Ping the target monitor from the Service Computer.
   - If Ping is successful, check the boot parameters settings in the target monitor.
   - If Ping fails, troubleshoot the network connections and verify IP Addresses of the monitor and Service Computer.

5. The Service Computer is not on the expected IP address of 164.90.254.66.

   - From the Command Prompt, type *ipconfig/all*. Verify the network connection you are using for programming is set for 164.90.254.66.

Unit appears to program correctly, but the CHECKSUM fails:

Verify the *readme.txt*, *bootrom.bin*, *app.bin*, and *fd_image.bin* (or) *fd_image_c.bin* files are from the same software version. Download all of the files again the Spacelabs Healthcare website if necessary.

If the checksums still do not match after a Flash burn, the CPU board will need to be replaced.

Monitor returns Checksum Mismatch when burning the fd_image.bin or *fd_image_c.bin*:

The checksum resides in the file itself, so if the checksum fails, the file is corrupted. Download all of the files again from the the Spacelabs Healthcare website if necessary.

Monitor reports "System Software Failure" after POST completes:

System software failure. Review error log for further details.

Figure 30: System Software Failure

The System Software Failure message indicates an incompatibility between the *Bootrom.bin, app.bin*, and the *fd_image.bin* (or *fd_image_c.bin*) files.

Use the Error log.

- Enter Extended Diagnostics. Select the **E - error log** functions… key, and then the **d - dump error log** key.
- Query the error entry to determine where the software failure occurred: Boot sector, App sector, or Flash Drive.
- Reprogram the monitor from the beginning (boot section, then app section, and then the Flash Drive section).

Mixed files in the *c:\salish\app* (or) *c:\Qube\app* (or) *c:\mini\app folder*.

- Verify all files are from the same software version. Download all of the files again from the Spacelabs Healthcare Website if necessary.
- Reprogram the monitor from the beginning (boot, then app, and then the Flash Drive section).

The *internal* USB Flash File System could be corrupted. Reformat the internal USB Flash Drive.

- Enter Extended Diagnostics.
- Select the **f - format USB file system** key, and then the **f - Format internal USB drive** key.
- Select the **D - run diagnostics…** key, and then the **R - Reset monitor (cold boot)** key.

Appendix B: Service Computer Connections

Overview

An Ethernet network connection using the TCP/IP protocol is used for programming Spacelabs Healthcare patient monitors.

Ethernet Hardware Network Connection
A simple RJ45 Ethernet cable connected between the monitor network port and the Service Computer network port is all that is needed.

However, Spacelabs patient monitors, and some early computer NIC adapters, do not auto-detect the connection (MDI-X). In those cases, use a crossover network cable, or use a network switch.
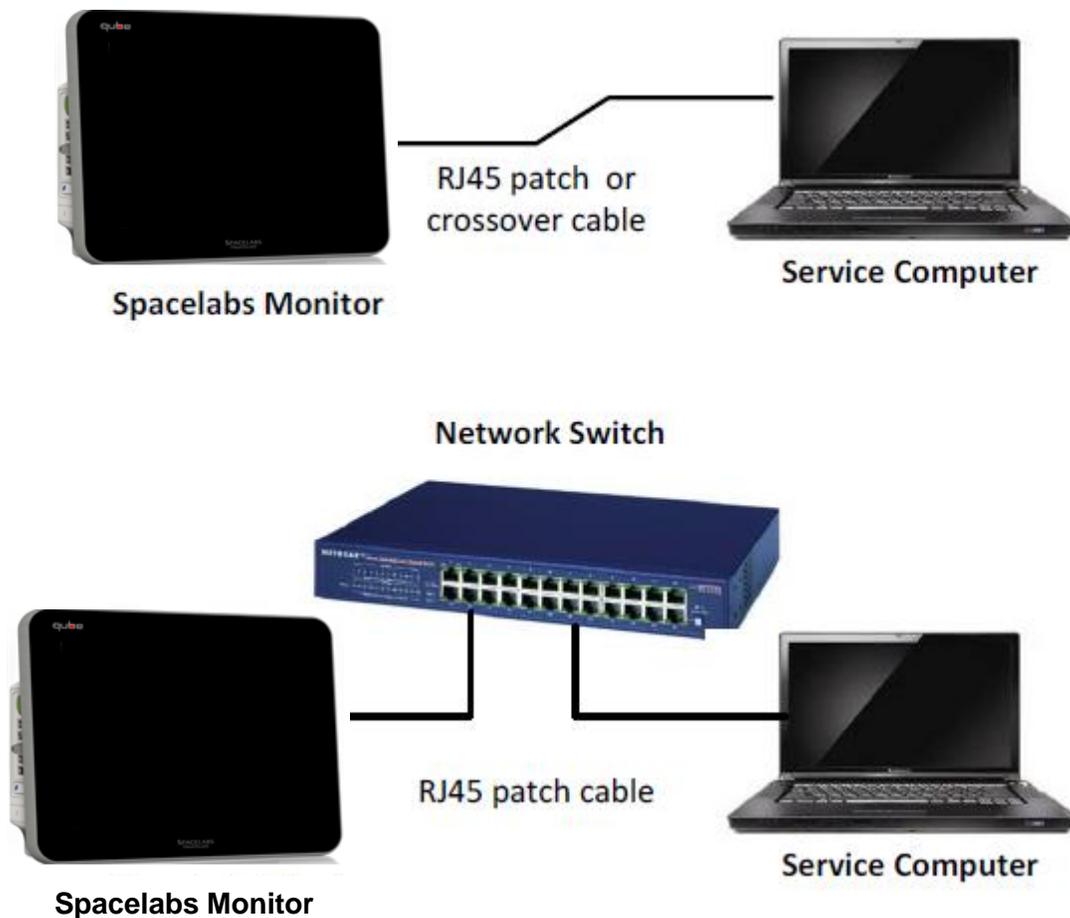
Figure 31: Service Computer network connections

TCP/IP Settings

Service Computer By default, all Spacelabs patient monitors expect the Service Computer's IP address to be 164.90.254.66, with a subnet mask of 255.255.255.0. How to change the IP address on the Service Computer is OS-version dependent. Use Windows Help (click on the desktop, then F1) if you need help in changing the network settings on the Service Computer.

Patient Monitors The default IP network address for Spacelabs Healthcare patient monitors is 164.90.254.0/ 255.255.255.0. The actual *factory-default* host address of the monitor depends on the "family" to which it belongs:
- UVSL 164.90.254.10/ 255.255.255.0
- Xprezzon /Qube /Qube Mini 164.90.254.10/ 255.255.255.0.

If the monitor is using the Spacelabs default-addressing scheme, there is no need to change its IP address.
However, in most cases, the IP address of the patient monitor to be updated will have a private IP address assigned to it by the hospital IT Department. In those cases, it is best to first document the monitor existing IP configuration, and then change it to the factory-default settings. Of course, once the monitor software update is completed, you must return the settings to their original values.

Verifying the Connection
Once the proper Ethernet connections and IP settings are made, test the connection from the Service Computer by using the PING command from the CMD Prompt. See Figure 32.
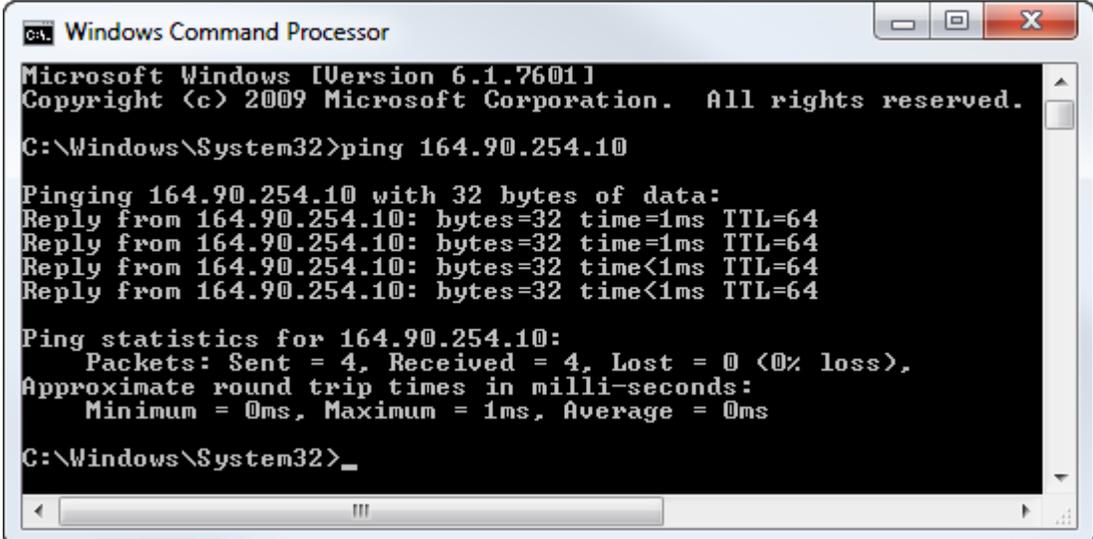

Figure 32: Verifying network connection

Alternately, UVSL, Xprezzon, Qube and Qube Mini monitors have a PING utility in their Extended Diagnostics menu. By default the PING function will ping the Service Computer's IP address of 164.90.254.66.

If PING fails, try these steps:
1. If a gateway is defined in the monitor, but not actually present, the PING command will fail. Remove the gateway entry from the monitor, and retry PING again.
2. Temporarily turn off the Windows Firewall, or whatever firewall is installed.

Appendix C: Installing FileZilla File Transfer Protocol

Update the software in Spacelabs Healthcare patient monitors via an Ethernet network using the (TCP/IP) File Transfer Protocol (FTP). The patient monitor is the FTP client; the FTP server is on the Service Computer.

FileZilla is an FTP Server for Windows and is compatible with Spacelabs software load procedures.

Download the FTP Server Application

FileZilla is a free FTP solution. It is open source software distributed free of charge under the terms of the GNU General Public License. To download the application, open your web browser and go to https://filezilla-project.org/, only the standard server product is required. Click on the download button for the FileZilla Windows FTP Server. Save the .zip file to any temporary folder on the Service Computer

Once downloaded, install FileZilla using default settings on the Service Computer (laptop used to install monitor software.)

Configuring the FileZilla FTP Server Application

After installation the administrative interface will start. Connect using localhost on port 14147. No password.

The default settings for FileZilla Server are not immediately compatible with Spacelabs monitors. To configure FileZilla Server follow these instructions:

1. From the *Edit* menu select *Settings*
2. Choose *Passive mode settings*.
3. Choose *Use the following IP* and enter *164.90.254.66*. This is the IP address of the Service computer itself.
4. Click OK.
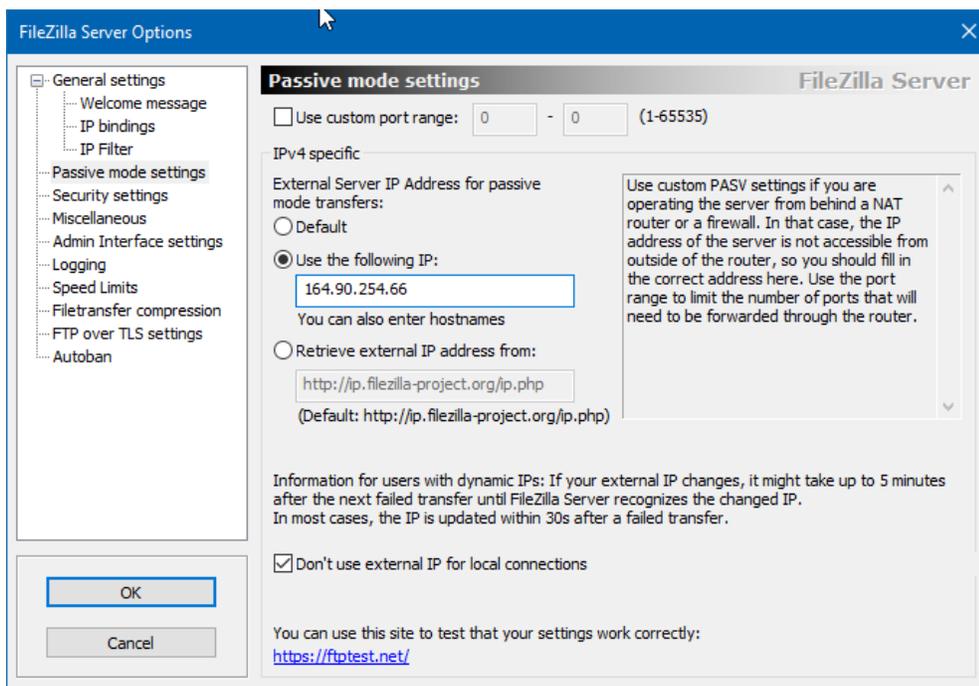
5. From the *Edit* menu choose *Users.*
6. Select the *General* page.
7. Under the *Users* list, select *Add.* Enter **Target** as the user name, and then click OK.
8. Check the *Enable account* checkbox
9. Check the Password checkbox. Enter **passwd1** in the password field.
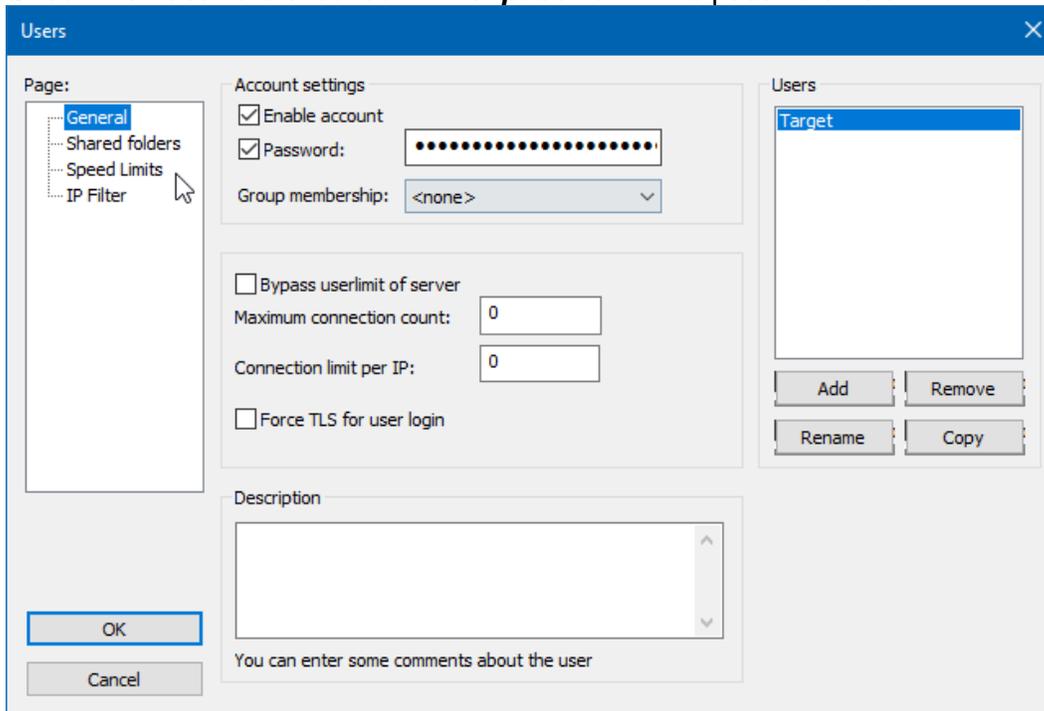
10. Select the *Shared folders* page.

11. Under the Shared folders list, click *Add*
12. Browse to and select C:\.
13. Under *Files*, make sure only the *Read* checkbox is checked
14. Under *Directories*, make sure only the *List* and *+ Subdirs* checkboxes are checked.
15. Click OK.
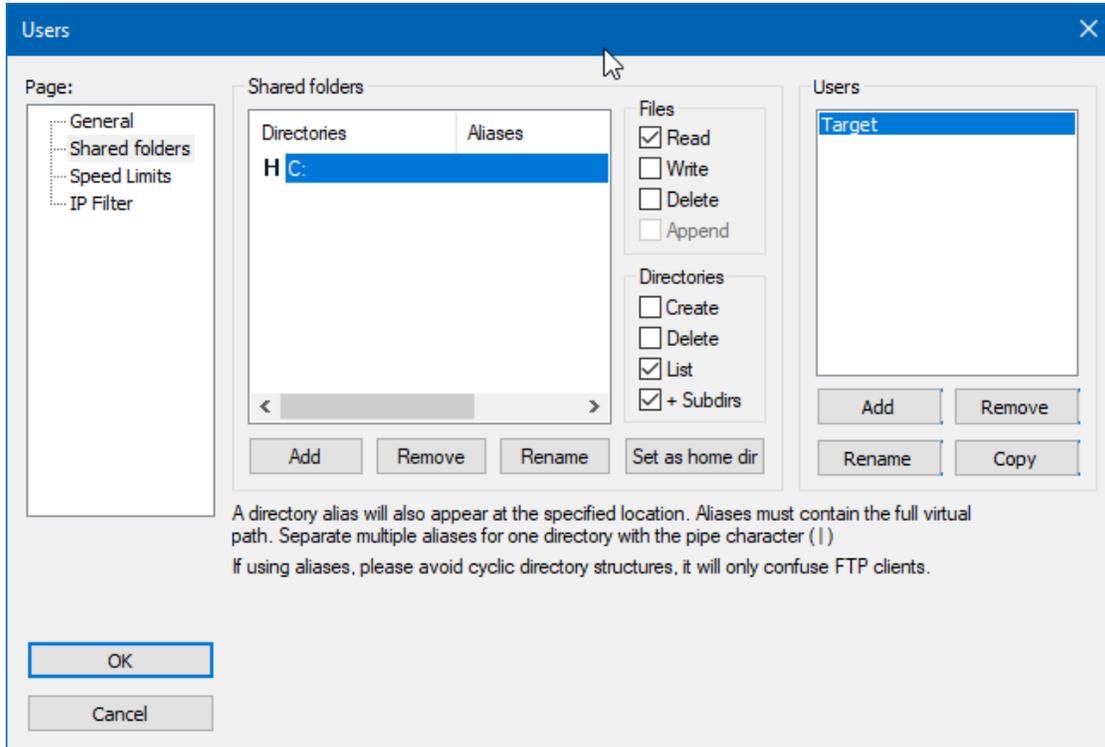
Appendix D: Configuring MD5summer to validate .md5 hash files

You must have administrator rights to do this procedure.

Windows 10:

1. Create a folder named *MD5 Summer* in the root of the C:\ drive. (**C:\MD5 Summer**)
2. Copy the *md5summer.exe* and *md5summer.md5* files to the C:\MD5 Summer folder
3. Double-click on the *md5summer.md5* file. Windows will prompt you for an app to open the file.
4. Choose *More Apps*, scroll down the list, and then click *Look for another app on this PC*.
5. Browse to **C:\MD5 Summer** folder, and then choose *md5summer.exe*.
6. If you receive an information window stating that MD5summer failed to set file associations, click OK and close all associated windows.
7. Right-click on *md5summer.exe*, and then choose *Run as Administrator*. Choose YES in the UAC window. Close the md5summer window.
8. File association for any .md5 file is now permanently set to open with *md5summer.exe*.
9. In the 3.08.03 software folder, double click any MD5 file to verify integrity.

Windows 7:

1. Create a folder named *MD5 Summer* in the root of the C:\ drive. (**C:\MD5 Summer**)
2. Copy the *md5summer.exe* and *md5summer.md5* files to the C:\MD5 Summer folder
3. Double-click on the *md5summer.md5* file. Windows will prompt you for a program to open the file.
4. Choose *Select a Program from a list of installed programs*, and then click OK.
5. Click the *Browse* button, and browse to the **C:\MD5 Summer** folder, and then choose *md5summer.exe*.
6. Make sure the *Always use the selected program to open this kind of file* checkbox is checked, and then click OK.
7. If you receive an information window stating that MD5summer failed to set file associations, click OK and close all associated windows.
8. Right-click on *md5summer.exe*, and then choose *Run as Administrator*. Choose YES in the UAC window. Close the md5summer window.
9. File association for any .md5 file is now permanently set to open with *md5summer.exe*.
10. In the 3.08.03 software folder, double click any MD5 file to verify integrity.